

Outcomes of the Upper North Water Use Efficiency Project

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Project Title: UNF0001. Increasing farm water use efficiency in the Upper North of South Australia

Project Duration: 2008-2013

Key Points:

- **The goal of achieving a 10% increase in water use efficiency appears to have been achieved quite comfortably as evidenced by the entry and exit survey results.**
- **Farmers in the Upper North District have made substantial gains in knowledge, skills and practice change to increase their water use efficiency.**

Project Summary

The low rainfall mixed farming systems in the Upper North of SA had shown poor gains in Water Use Efficiency (WUE) for a number of years leading up to this project. This project identified a number of key areas which could potentially lift WUE and improve long term sustainability of local farmers through improved productivity and profitability. The Upper North Farming Systems (UNFS) group worked with its members and others in a participatory R,D and E approach which saw local farmers implementing practice changes in a number of areas. The project resulted in a demonstrated improvement in WUE and the building of capacity amongst the local farming and agribusiness community.

Background and Importance of Issue

The Upper North farming region of SA had experienced a difficult period in the decade leading up to the commencement of this project with a series of poor seasons that had a negative impact on profitability. Assessments of Water Use Efficiency at both shire and farm level showed that, in many cases, local production systems were not making good use of available moisture. WUE had shown little recent improvement and, in some cases, had actually declined. Most producers were still surviving reasonably well, however there were opportunities to improve production and business management skills to achieve substantial gains in productivity, profitability and farm business resilience.

A number of focus areas were identified which were seen as having the potential to improve the situation. One of these areas was the fact that the region receives significant summer rainfall in some seasons, which provided both risks that need to be managed as well as opportunities that could be capitalised on. As part of the project a series of trials, demonstrations as well as coordination of research results across the WUE initiative provided a large RD&E effort.

Entry and exit surveys were conducted as part of the project to evaluate Knowledge, Attitudes, Skills and Adoption (KASA) and to provide information regarding changes to WUE over the life of the project. This has enabled UNFS to get a better understanding of where farmers in the area were at the start of the project and how this has changed. The surveys have enabled the group to understand more about farming systems in the area and opportunities for the future.

Major Achievements of the project

1. Increased WUE as demonstrated by the Entry/Exit Survey

Yield data collected as part of the survey has been compared to APSIM generated yields for representative soil types and rainfall stations in the region. While there is a considerable margin for error in these numbers, it shows from 2010 to 2012 average water use efficiency across the three major soil types in the Upper North increased significantly compared to that achieved in the 2007 to 2009 period.

On the clay loam soils average farm yield as a percentage of APSIM water limited potential yield relative to a sandy loam increased from 25% to 51%; on the limestone rises from 24% to 50% and

on sandy loam soils from 48% to 73%. The data has been back transformed giving a mean change from the entry survey of 81% (weighted mean of 89%).

From 2010 to 2012 farmers had improved Water Use Efficiency in crops by:

- a. *Increased adoption of summer weed control (85% of growers ranked controlling summer weeds in the top 3 priorities)*

At the start of the project (entry survey) summer weed control did not feature in the three most important practices for WUE in crops. In contrast the exit survey showed that farmers now regard it as the most important with 65% of UNFS farmers controlling summer weeds in over 75% of their cropping area. The main reasons identified by farmers for summer weed control are to conserve moisture for a tough spring and moisture conservation to enable earlier and more timely seeding.

- b. *Importance of timely crop establishment as early as possible in the growing season. (56% of growers ranked sowing early/dry in the top 3 priorities).*

The average earliest date growers are prepared to start sowing is currently 17th April, standard deviation 11 days. Range 28th March to 15th May.

In the last 5 years 45% of growers have not changed how early they will sow (most of these are in low frost risk areas and were already sowing very early), however the remaining 55% are now prepared to sow on average 13 days earlier than 5 years ago.

- c. *Improved agronomic practices within the growing season – weed control, fertilizer management P & N and disease control.*

- i. Yield Prophet has been extensively evaluated in this environment and has been well accepted by farmers as a way of improving nitrogen management and leaf disease management to protect yield potential.
- ii. Efficacy trials on grassy weeds (barley and brome) have been conducted as part of the project with funding from other sources
- iii. Applying addition nitrogen fertiliser, particularly in-crop.
- iv. Cropping is being concentrated on the better soil types with poorer cropping soils being left for pasture (two or more years of pasture)

- d. *Selection of appropriate crop and pasture varieties.*

Local variety trials combined with NVT data have demonstrated the value of new varieties with a rapid uptake leading to improved yields.

2. Validation of APSIM soil moisture modelling

- a. *Measured moisture at a summer weed control trial was compared to modelled moisture levels from APSIM with a good correlation, increasing confidence in the model.*
- b. *Article written and published in Groundcover*
- c. *Results presented to Agronomy Conference in NZ, 2010*

3. Grazing management for low rainfall areas

- a. *Consolidation of grazing management information from a range of sources, targeting low rainfall cereal/livestock farming systems into a comprehensive manual.*
- b. *Grazing management workshops and field days conducted to improve pasture utilization and grazing efficiency*

Improved livestock management, integration of more grazing land and intensification of grazing systems has seen an increase in lambing percentages, higher stocking rates and an overall increase in total number of livestock. Effective integration of livestock in these predominantly mixed farming systems continues to be an important driver of water use efficiency.

This component of the project was successful in value adding by using other funding sources to develop and deliver improved methods of pasture production and utilisation enabling most of the milestones to be delivered as anticipated. Other funding sources such as DAFF (Caring for Our Country, Australia's Energy Future) and SA state government (DWENR) have been particularly significant in the delivery of milestones 5, 6 and 8. Collaboration has also provided capacity building to growers in livestock management. A barrier in this regard is the industry wide lack of availability of skills and delivery capacity in improved livestock management.

4. Improving balance between profit and risk in a highly variable environment

- a. *A range of workshops to better understand the drivers of profit and the relationship to risk.*

The way farmers manage risk changed over the life of the project. The use of higher value, lower risk crops (wheat and barley) remained the top priority, sowing only the most reliable paddocks moved from 6th to 2nd place and altering cropping/livestock balance moved from 2nd place to 6th. The use of most other risk management strategies remained relatively similar in priority.

The capacity of local farmers to address profitability and risk in this marginal environment has been addressed through workshops and other programs aimed at building a better understanding of the economic relationships important to local farm businesses. This work was supplemented by funding from the Low Rainfall Collaboration Group Profit/Risk project.

- b. *Several articles produced for Groundcover “How much Machinery is too much?”, “Analysing the economics of machinery purchases”, “Weather change drives need for more flexibility”.*

5. Capacity building of the local farming and advisory community

This project has provided a core source of funds to enable the Upper North Farming Systems group to continue as an effective organisation in building the capacity of its members and the local farming community to identify and address key issues for long term sustainability in the local farming environment. Over the course of the project, the UNFS group has evolved with the local farming community providing strong support for its role. The UNFS has been used by many other organisations for delivery of RD &E efforts into the region.

Economic Benefits

Improved profitability of crops and pastures was achieved through better WUE practices such as summer weed control, earlier sowing, improved in crop agronomy and better variety selection.

The mean increase in average Farm yield as a percentage of APSIM was 81% in the Upper North from the 2007-09 period to the 2010-12 period.

1. Growers in the UN are now prepared to sow earlier with 55% now prepared to sow on average 13 days earlier than 5 years ago. By moving the sowing window back the last crops sown will have significantly improved WUE. The main reason for delaying sowing is to wait for grassy weeds to germinate, followed by capacity of machinery, risk of frost and demands of livestock for feed.
2. Farmers in the UN have become more targeted with fertiliser application:
 - a. 32% have reduced P by 30% to improve the balance with nutrient removal and also better allow for high soil P reserves
 - b. 74% are applying additional N fertilizer, with 42% applying more in crop. Most are making the decision using available soil moisture, Yield Prophet and weather outlook.
3. Growers have improved crop sequences to maximize returns over the whole farming system
 - a. Preferred break crops are pasture (59%), vetch (46%), peas (41%), lupins (23%) and canola (13%).
 - b. 76% of growers use two or more break crops in a row, depending on seasonal conditions and weed levels. This has increased substantially from the entry survey.
 - c. 72% of farmers use break crops to control grass weed levels, 59% to increase N supply to following crops, 54% to provide feed for livestock and 51% to control root diseases. This shows a good understanding of the role of break crops.
4. Currently 54% of farmers match sowing date to variety with longer season varieties sown first.

In addition, an increased capacity to assess profitability and risk trade-offs mainly in the area of input investment, both variable (fertilizer, pesticides, crop type etc.) and capital (plant and machinery) was developed across the districts farmers.

Environmental Benefits

Higher levels and extended periods of ground cover reducing water and wind erosion through;

1. Increased biomass through improved WUE practices
 - a. There has been an increase in the number of farmers dry sowing feed crops
 - b. The number of farmers sowing cereals for grazing only increased from 32% of respondents to 41% over the project.
2. Trials clearly demonstrated that long term chemical fallow achieves the same benefit as long term mechanical fallows while maintaining ground cover. Mechanical fallow declined from 4.5% in the entry survey to less than 3% in the exit survey and no-till increased from 56% of mean cropping land to 64%.
3. Farmers have improved grazing management through a combination of confinement feedlots, grazing cereals, rotational grazing, improved livestock water supply and pasture budgeting.

In the exit survey there was a shift in farmer's attitudes to increasing WUE in livestock enterprises from pasture improvement / production to improved grazing management and use of confinement feedlots.

Social Benefits

There is evidence of increased retention of family members on the farm over the course of the project with a flow on benefit to the community. In the entry survey only 36% of farms had other family members employed on the farm with 49% in the exit survey. The number of family members employed per farm has increased from 0.55 in the entry survey to 0.67 in the exit survey. This would indicate that an increasing number of sons and daughters are now working on the farm. There is anecdotal evidence to suggest that this trend will continue. This may reflect improved profitability as an outcome of this project.

In 5 years management over 50% of farm business will either include sons/daughters for the first time or be handed over to the next generation.

The number of farmers in the project area declined over the life of the project and the workload of the remaining farmers increased. Average farm business size has increased significantly from 2,038 ha to 2,859 ha (40%) from 2009 to 2012, There has also been a shift in enterprise mix with average crop area increasing by 8%, sheep pasture area by 30% and cattle area by over 1,000% (distorted by the purchase of a large pastoral property).

It remains an ongoing challenge to achieve engagement of farmers under these circumstances. In spite of this, local farmers supported the project well, along with strong support from local commercial agribusiness.

Conclusions

The Upper North had experienced a difficult period leading up to this project and there was a strong need to improve farm performance. To this end, the goal of achieving a 10% increase in water use efficiency appears to have been achieved quite comfortably as evidenced by the survey results. This has been achieved by targeting a few key areas of greatest opportunity. Farmers in the UN have been able to make substantial gains in knowledge, skills and practice change.

The project has been critical in ensuring the continuation of the UNFS group, which has been a major vehicle for demonstration, extension and adoption of new agricultural technology and practices. The group has also played a key social role during periods of climatic and financial stress with group members able to share successes and failures and all learn from these.

Recommendations

The WUE initiative has generated significant momentum to improve farming systems across southern Australia and it is vital that this momentum is not lost. Future projects need to build on the success of this approach.

APSIM has been a significant tool to improve growers understanding of soil water and crop growth and to evaluate the outcomes of the project. There are still gaps in the soil types available and soil characterisation is critical for the accuracy of the model. A review of current soil characterisations needs to be undertaken and a plan put in place to fill any gaps.

Increased plant available water at seeding by improved summer weed control practices has been an important driver of productivity gains achieved under this project. It is likely that effective summer weed control will become increasingly difficult to achieve due to the selection of herbicide tolerant or resistant weeds. It will be important to support ongoing research efforts into emerging summer weed issues to maintain the advances made in this area.

The use of long season varieties was explored as part of the project, however further work is needed to give growers and advisers confidence to adopt this innovation.

